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ABSTRACT

The four reports grouped together here are: (1) "Report on Computer Hardware in Schools and Units for the Visually Handicapped, 1983" (Paul Blenkhorn and Michael Tobin); (2) "Micro-Computers with the Deaf-Blind" (Paul Blenkhorn); (3) "Some Guidelines for Evaluating and Adapting C.A.L. Software with the Visually Handicapped--Using a Screen" (Paul Blenkhorn and Michael Tobin); and (4) "Teletext for the Visually Impaired" (Paul Blenkhorn and Brian Payne). All four reports address the use of educational technology with visually impaired students. In the first report, results are presented from a survey on computer hardware completed by 32 schools and units in the United Kingdom containing visually handicapped children. The distribution of hardware and the models of computers used are depicted. In the second report, ways in which microcomputers are used with deaf blind students are described. Applications are noted for students with some vision as well as students with no vision. The third report offers guidelines for evaluating and adapting computer-assisted instruction software with visually handicapped students. Factors in the program, including the students' perceptual skills, are considered along with factors outside the program, such as reproduction of supplementary materials in braille or large print. The final report discusses access to Teletext, an information service transmitted over the airwaves together with normal television programs. (CL)

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[Four Reports from the Research Centre for the Education

of the

Visually Handicapped]

1983-1985

Research Centre for the Education
of the Visually Handicapped
Faculty of Education
University of Birmingham

EC 182726

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REPORT ON COMPUTER HARDWARE IN SCHOOLS AND UNITS FOR THE VISUALLY HANDICAPPED, 1983.

Paul Blenkhorn and Michael Tobin

1983

RESEARCH CENTRE FOR THE EDUCATION
OF THE VISUALLY HANDICAPPED
FACULTY OF EDUCATION
UNIVERSITY OF BIRMINGHAM

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REPORT ON COMPUTER HARDWARE IN SCHOOLS AND UNITS FOR THE VISUALLY HANDICAPPED, 1983

This paper contains the results of a survey undertaken at the Research Centre for the Education of the Visually Handicapped in the summer of 1983. It provides information on both the general computing facilities available and the range of computers used in schools.

INTRODUCTION

On the 1st September, 1983, the Research Centre for the Education of the Visually Handicapped started a research project into computer assisted learning (CAL) in the education of the visually handicapped. This report will be biassed mainly, but not completely, towards the use of microcomputers in the education of children and will run for three years. There has been a rising interest in the use of computers for the visually handicapped recently, and an R.C.E.V.H./A.E.W.V.H. working party has been in existance for over 12 months. During January, a C.E.T.-sponsored conference for teachers interested in CAL was held. The field seems now to be generally moving rapidly onwards.

This survey was sent out to determine the extent of the infiltration of the new technology as this is likely to affect the direction of the research project.

CONTENTS OF THE SURVEY

In the summer term of 1983 a questionnaire was sent to 65 schools and units in the U.K. containing visually handicapped children. The questionnaire was divided into a section on the hardware (i.e. the physical machines) available in the schools, and a section on the software (i.e. the computer programs) used in the schools. The software is not discussed in this paper but it does seem clear that suitable (let alone specially-designed) material seems to be rather scarce. The section on hardware enabled the schools to specify the range and number of the computers used by them (and which of these had disc drives) and the peripherals attached to the computers (i.e. printers, speech synthesizers, etc.). An area was left on the form for "any other information which you judge to be of use".

DISTRIBUTION OF HARDWARE IN SCHOOLS

Table 1 shows the overall results of the survey and, as it will be seen, the returns (49%) are somewhat low. Although there is no hard evidence to support the claim, it is probably the case that many of those that did not respond had no resources of this kind available and so unfortunately did not consider it worthwhile responding. These figures include six schools who have computers on order.

Table 1. Basic Information

A1	Number of schools sent forms	65
A2	Number of forms returned	32 (49% of A1)
A3	Number of schools with microcomputer(s)	26 (81% of A2)
A4	Number of schools with printer(s)	12
A5	Number of schools with speech synthesizer(s)	9
A6	Number of schools with concept keyboards	4
A7	Number of schools with braille printers	4
A8	Additional hardware in schools: Perkins brailler connected to computer; large character terminals; microwriters; Versabraille.	

Of the 32 schools replying, only six did not have any computers. Three of these, however, did say that they hope to get a machine. This figure of only six without computers is considerably smaller than was expected and, comparing it with what was known to be available 12 months ago, indicates a marked increase in the overall up-take. Several of the schools have printers but it is interesting to note the obvious interest in other peripherals such as the speech synthesizers and concept keyboards. Of particular interest is the conversion of a Perkins brailler to be used with microcomputers (Smith and Vincent, 1982) which opens up a wide vareity of applications.

Table 2 shows the distribution of the computers in the different classes of school. The division between the special schools for the visually handicapped and the other kinds of schools with some visually handicapped children was made because, from some of the forms, it was unclear whether the non-specialist school had any software suitable for the visually handicapped. It is also unclear as to whether the distinction between partially sighted and blind schools can be made, since many in each category have children with a wide range of visual acuities. This division has, nevertheless, also been made. The most striking aspect of these results is the high variance in the number of machines in the schools. As has been stated, six had no computers at all yet several had over five.

Table 2. Distribution of Computers in the Different Classes of Schools

	No. of Schools in Sample	Number of Computers in Schools			
		n	%(of 76)	Mean	S.D.
B1 Special Schools for the Blind	11	23	30.26	2.09	2.35
B2 Special Schools for the P.S.	11	29	38.16	2.64	2.67
B3 Totals for Special Schools for the V.H.	22	52	68.42	2.35	2.53
B4 Schools other than Special Schools for V.H.	10	24	31.58	2.40	2.05
B5 Totals for all Schools in Sample	32	76	100	2.38	2.39

VARIETY OF COMPUTERS IN SCHOOLS

One of the major reasons for the survey was to discover the different models of computer used. These are shown in Table 3.

Table 3. Models of Computers Available

Model	No. of Computers (out of 76)	No. with Disc Drives	No. of Schools with Model (out of 32)
BBC B	40 52.1%	22	22 68.8%
RML*	8 10.4%	8	7 21.9%
APPLE II	7 9.1%	7	5 15.6%
ZX81	3 3.9%	0	2 6.3%
SUPERBRAIN	2 2.6%	2	2 6.3%
BBC A	2 2.6%	0	2 6.3%
VIC 20	2 2.6%	0	2 6.3%
NASCOM 3	3 3.9%	0	1 2.6%
VISUALTEK VOYAGER	2 2.6%	2	1 2.6%
PET	2 2.6%	1	1 2.6%
ZILOG Z-LAB (16 User System)	1 1.3%	1	1 2.6%
ZENITH Z100	1 1.3%	1	1 2.6%
SPECTRUM	1 1.3%	0	1 2.6%
ALPHA VISION	1 1.3%	1	1 2.6%
MAGNI LINK	1 1.3%	1	1 2.6%
Total number of Computers = 76.		Total number of Drives = 46.	

*Note: There was some doubt, from some of the forms, whether the respondants had an RML 380Z or an RML 480Z. However, as all the machines had disc drives it is probable that they are all 380Zs.

It is immediately obvious that the BBC model B dominates the figures with 22 of the 26 schools with micros having that computer, and in fact all the computers which were "on order" were BBC model Bs. The greatest problem with such a wide range of models used is that it is highly unlikely that any program which runs on one of the machines will run on any of the others without major modifications - particularly if graphics are used at all. The lack of disc drives for many machines is both as expected and disappointing. It is well known in the CAL world that many teachers are put off by "bad computer experiences", the major cause of which is the loading of programs from cassettes.

CONCLUSIONS

It seems clear from the survey that there is a great interest in the use of microcomputers in schools, and that the extent and depth of the interest have been accelerating lately. This interest is widespread for both the blind and partially sighted and across a variety of schools. Less clear, though, are the applications to which the microcomputers are being made, with many schools leaving their software section blank or at least almost blank.

The amount of hardware available is pleasingly more than was expected and yet of as great a variety as was feared. To try to develop material for such a range of models is not practical with the resources available. However, if we can predict anything from this survey it is that over the next year or two the majority of schools will continue to purchase the BBC model B. Thus, the domination of the BBC model B should result in its being the main computer used in the research project with most educational software being produced for it. (It should be noted that many of the programs developed for the BBC model B by the research project will only work if used with a disc drive.) If a second model of computer is to be adopted then it is likely that it will be one of the RML (Research Machines) computers. It will be interesting to observe any changes in the numbers and types of micro-computers in the schools when the survey is repeated next year.

Although the BBC model B is to be used extensively for this research project, it is prudent to note that two or three years ago most educational software for schools was being developed for the RML 380Z. With the rapid changes in this field another computer may arrive quite soon. If any of the software developed by this project is to be of use in the future the portability of the software (although secondary, of course, to its educational value) must be taken to be of considerable importance, and should thus be designed and implemented accordingly.

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MICRO-COMPUTERS WITH THE DEAF-BLIND

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MICRO-COMPUTERS WITH THE DEAF-BLIND

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Paul Blenkhorn

This article will describe some of the ways in which micro-computers are currently being used with the deaf-blind. In the main it will consist of some of the work which has been and is currently going on as part of the Computer Assisted Learning for the Visually Handicapped project at the Research Centre for the Education of the Visually Handicapped at Birmingham University.

Although it is somewhat artificial to categorise deaf-blind people they shall be considered here under two main headings:

i) Those with some vision, and
ii) Those with no vision.

It should be made clear that most of the recent work which has been done in this area is mainly forchildren, although some of the applications are relevant to adults. Also, although some general points can be made regarding what users have done with the computer, it has to be remembered that each user is an individual and assumptions should not be made about any individual - the equipment and/or programs should be tested "in person". All of the work has been based on the BBC micro-computer.

THOSE WITH SOME VISION

There are several general points which emerge when we look at visually impaired children with some sight using computers. Firstly, there seems to be something about the images on a screen which can be both very attractive and clear to see/read. Some initial testing by Chris Painter at Condover Hall School has shown some favourable results when comparing what the children could read on paper with what they could read on a screen. The current thinking is that the images on a screen are bright and "glow". This is particularly striking in a darkened room, and can make the information easier to read. This means that some programs can be used with children who have very little, but some, vision. It is really a matter of trying it out. Secondly, many programs are interactive and the computer reacts very quickly even if it is in a very crude way. Also, the fact that, the computer is, in many instances, fun to use and the children don't regard using it as work can be readily exploited. Overall it can be said that for most children, using the computer is highly motivating - a point which is also true of their sighted peers, but which should still not be undervalued.

For some of the children, with a fairly high level of sight, it has been found that they can use the standard programs which have not been designed for the visually impaired. However, some work has been done on producing software specifically for the visually impaired. Most of the Research Centre's work which has been of relevance to the deaf-blind has been in the area of trying to encourage children to use their sight, and a variety of programs have been produced. What I want to consider here are some of the more recent programs which have been developed and which use a Cheyne Scribbler.

The Cheyne Scribbler is a frame which can be positioned in front of a screen or which can be used flat on a table or lap. When used in front of a screen the screen becomes "touch sensitive". It should be noted that the programs which work with the Scribbler when it is used as a touch screen will also work with the Microvitec Touch Tech 501, although that touch screen is not yet, at the time of writing this article, on the market.

So far programs have been produced which:

(a) Encourage a child to just touch the screen. When they do touch the screen something 'interesting' will happen.

(b) Put a target onto the screen which the child has to touch.

(c) Enable a wide variety of matching and discrimination exercises to be both given and produced. There are eight discs of programs in this area covering size, colour, various shapes and patterns, characters and words.

As was stated earlier, using the computer can be very motivating for children. What is becoming clear is that for many of the less able, who have the motor control to use it, the touch screen is a very natural and flexible device to use. For some time we have seen children touching screens when they first see pretty pictures on a screen. It is now delightful to see their, sometimes startled, reactions when the computer responds.

As a result of some collaboration with the HASICOM project several programs have been produced which work with clear text on the screen. These can be regarded as being communication aids for those with poor sight. They include programs for reading and writing text, printing out clear text on a printer, reading CEEFAX and ORACLE and accessing the TELECOM GOLD electronic mail system.

THOSE WITH NO VISION

Here I shall assume that the deaf-blind individuals do not have enough hearing to hear synthetic speech.

The situation is somewhat embarrassing in terms of programs available for the less able children with no sight. If they have no hearing whatsoever and do not use braille then I do not know of any materials which are available. If there is some hearing but still no braille then there are some very simple programs which may be used, but these are still quite small in number.

For those who know braille the situation is a little less bleak in terms of materials but becomes depressing in terms of cost. As far as I know the VERSABRAILLE is the only braille device which is currently being connected to a computer and used by the deaf-blind (and it costs over £6,000). It can be used, with appropriate peripheral devices, to read CEEFAX and ORACLE in braille, to produce a braille document in Grade II braille which can be converted into print via the computer, or to access the TELECOM GOLD electronic mail system. (For TELECOM GOLD the computer is not needed).

I think that in general one can say that the computer is being used more and more with the deaf-blind and there is certainly a good deal of justifiable interest. However, it must be made clear that the developments are by no means applicable to all deaf-blind people and where they are relevant in most cases should be seen to complement rather than replace existing methods.

Any enquiries concerning the HASICOM project should be directed to:

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SOME GUIDELINES FOR EVALUATING AND ADAPTING C.A.L. SOFTWARE WITH THE VISUALLY HANDICAPPED - USING A SCREEN

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JUNE, 1984

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SOME GUIDELINES FOR EVALUATING AND ADAPTING C.A.L. SOFTWARE WITH THE VISUALLY HANDICAPPED - USING A SCREEN

This paper outlines some of the major points which need to be considered when looking at screen-based software for the visually handicapped. It is primarily concerned with just those criteria that are of particular relevance to users with poor sight.

INTRODUCTION

The aim of this paper is to remind users of educational software of some of the criteria that ought to be considered when using materials with the visually handicapped. It is not intended as a global panacea for all of the problems associated with the area but rather as a series of useful hints gleaned from experience. We make no apology for repeating many of the lessons learnt from using close circuit T.V. and ultra-violet light. (When used in a darkened room the emitted light from a computer screen can share some of the features which make U.V. light work useful - e.g. there is no background light to distract the user's attention from the information close to hand.)

Interest in using the computer in education is increasing rapidly. This movement is, however, not without its bearers of caution: "There is every sign that the headlong rush into micros is causing a reversal to techniques and philosophies which had been discredited in computer-assisted learning many years ago. It is not that such techniques and philosophies are wrong - nothing in education is that simple - but that they present an impoverished view of what computer-assisted learning could be about." (O'Shea, T., Self, J., 1983).

Perhaps some care should be taken, therefore, in using the computer in the classroom. Nevertheless, in the visually handicapped field many new possibilities are being realised with the advent of the microcomputer. Some of these applications involve the use of synthetic speech (Vincent, T., 1983; Morford, R.A., 1983) but here we shall just consider the use of a microcomputer by those visually handicapped people who are able to use screen-based software. One point of consideration will be how existing software can be utilised with minimal effort for the visually handicapped. It is unfortunate for us, though, that many 'good' educational programs tend to use a screen 'well'. This means that information is up-dated on the screen in a non-linear way. Thus, to keep up-to-date on the state of all the information on the screen, one must continually scan the whole screen.

There are really two levels at which one can criticise C.A.L. software in general. Firstly, one can look at the content of the material, and secondly one can look at how that material is presented. The teacher must be the arbiter as to the appropriateness of the content to the curriculum and for the individual user. However, general rules can be applied to some of the ways in which this information is dealt with, and of course software should be free from the petty bugs such as correct validation of input (Brown, I., 1984); unfortunately, so much of it is not.

The software for the visually handicapped must hold its own against the above two benchmarks, but there are other criteria to consider in this case. Again, a division into two can be made, viz. those factors which are reliant upon the program and those factors which rely upon the environment in which the material is used. In a teaching situation these must, of course, be considered simultaneously, but for convenience here we shall look at them separately.

FACTORS IN THE PROGRAM

From an information-presentation point of view, a screen is significantly different from a printed page. For example, "Blank space on computer screen is 'free'. (Bork, A., 1982). Unlike paper-based media, the presence of blank space does not increase printing and reproduction costs. Information that should be logically separated for either conceptual or aesthetic reasons can easily be presented on two different displays, because it is no more expensive to use two displays than it is to use one." (Heines, J.M., 1984). Also, as was stated earlier, much 'good' C.A.L. software uses a screen in what might be considered to be an almost random way. This presents few problems for the sighted user who can assimilate the information on the whole screen with ease, but its situation must be examined carefully when the users are visually handicapped persons. Thus, when looking at a computer screen one must consider the amount of information on the screen and the order in which it is both presented and up-dated.

However, before the users can scan and take in the screen's information, they must first be able to take in the individual items of information. We suggest basically four factors to examine when looking at information on a screen:

(i) the colour (or black and white) and intensity of the information;
(ii) the contrast of that information with its surrounding;
(iii) the size of the information;
(iv) the speed of movement (or flashing) if appropriate.

A rule of thumb which we have started to use is to 'make the light on the screen contain the information'. Thus, if the child is to track a ball moving around the screen, then the ball (the information) would be in a bright colour (such as white, yellow, or green) and the background would be black. (If we did want to make this more difficult, though, we might choose 'unsuitable' colours accordingly.) This strategy then capitalizes on two of our perceptual capabilities - responsiveness to light and sensitivity to contrast.

It is interesting to note a trend in some quarters to treat a screen almost like a sheet of paper. The background is white (like most paper) and the 'figure' in the foreground is drawn in black. Although this seems to reduce the usefulness of such programmes to the visually handicapped, it is in most cases, a fairly simple matter to reverse the colours on the screen.

The size of information is a factor which is very much dependent upon the individual - especially when eye conditions in a group can vary from high myopia (with quite reasonable 'near vision) to hypermetropia (associated with poor focussing ability). Although movement is one of the ways to attract the eye, the rapid movements used by some software may not enable those with limited tracking ability to comprehend what is going on. It should be noted that the level of relevance of each of the above factors to the individual child must be left up to the teacher to decide.

In addition to the perceptual skills outlined above, we must also consider other abilities of the user. Does the program demand excessive keyboard skills? How long does the program take? It is well known that many individuals can become addicted to the computer, and care has to be taken, therefore, that children do not suffer eye strain. Again, the teacher must observe, decide, and intervene as appropriate.

FACTORS OUTSIDE THE PROGRAM

Although programs sometimes seem to be rather ephemeral events, they are actually used on physical equipment, the characteristics and environment of which we can modify to a certain extent. The brightness and contrast of the visual display can be adjusted within certain levels quite easily, but in addition one must consider the size and quality of the visual display unit purchased. Models can be obtained in various sizes, from the normal TV-at-home to high-resolution monitors which provide a far greater clarity. In some circumstances a black and white monitor may prove to be more suitable. Unfortunately, when we come down to reality, these alternative resources are often not available, but the factors affected by them should be considered when purchasing new equipment. To increase the contrast of the display, as well as adjusting the monitor, it can be useful to darken the room. This is not always possible but, in many schools the computer is always in the same room and the purchase of blinds or curtains for that room may be a simple solution to some child's problem. Of course, after a prolonged time in a darkened room, it would be prudent at the end of viewing for the light in the room to be increased gradually.

There are several different styles of programs available now. Some of these are intended for use by the whole class, some for individuals or small groups, and some which can be used in a variety of modes. When the material is screen-based, each user should be able to see the screen - at the appropriate distance for him/her. One way to alleviate this problem to a certain extent is to chain several displays together. Each display can then (within the physical constraints) be adjusted appropriately. This is not a total solution but might help (especially in a V.H. unit where the child might have his/her own monitor).

Where a program has supplementary materials, then obviously these may have to be produced in braille as large print. What should also be considered, though, is the reproduction of some of the material which is presented on the screen, e.g. instructions for use or practice material in a more accessible medium, either before or after the screen-based presentation.

Finally, when using materials with children with other handicaps, teachers will certainly be aware of the importance of a correct and comfortable position when the child is using the instructional materials.

CONCLUDING REMARKS

What we have not tried to do in this paper is to examine C.A.L. software in terms of its educational validity and its relevance, nor to look at existing programs in terms of their scaleability on a continuum ranging from 'purely testing of existing knowledge' to 'comprehensive and self-contained teaching of entirely new concepts'. Certainly, much of the current software falls nearer the 'testing of existing knowledge' end of the spectrum, and it might in due course be useful to ask teachers and reviewers to grade such software on, perhaps, a seven-point scale. This, however, is a topic for another paper.

What we have tried to give here are some 'helpful hints' on using the computer and screen with the visually handicapped. They are the result of observation and experience. There is a great need for some more systematic and rigorous work to be done in this area, since only then will we be able to fully exploit the new technologies for the benefit of the visually handicapped. If anything at all is to be taken from this paper, let it be a call for software to be produced with an adaptable screen format which can enable the program to be configured to the individual visually handicapped user.

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TELETEXT FOR THE
VISUALLY IMPAIRED

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1985

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TELETEXT FOR THE VISUALLY IMPAIRED

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Paul Blenkhorn and Brian Payne

INTRODUCTION

The aim of this article is to introduce the reader to some of the developments which are currently taking place in giving the visually handicapped access to Teletext. So what is Teletext? Teletext is an information service which is provided by the BBC and IBA. It is transmitted over the airwaves together with the normal television programmes. The BBC Service is called Ceefax, with Independent Television providing Oracle and 4-Tel. The information is transmitted in 'pages' and sub-pages, each of which has a distinct number. These pages contain information in a wide variety of areas including news, sport, finance and recreation, to name but a few. The pages are made up of a mixture of both textual and graphical information.

There is some comparison to be made between Teletext and Prestel, but there are significant differences. Prestel contains considerably more information than is available through Teletext and it does allow a user to interact with the information to a certain extent, for example through home banking. This is done by phoning a Prestel computer and 'asking' it to perform the appropriate tasks. Teletext, on the other hand, just keeps sending the same pages continuously through the air, and the user chooses which one to view. The major feature of the Teletext service is that it is totally free, provided that you have the suitable equipment to receive the television signal.

Following on from some initial work at the BBC which enabled the pages from Teletext to be read on a Versabraille in uncontracted braille, the Research Centre for the Education of the Visually Handicapped undertook to try to make the information on Teletext available in contracted braille, synthetic speech, and in large print. Much of this work is being done in collaboration with the HASICOM project, which is trying to give the deaf-blind (and those with varying degrees of hearing and sight) access to Teletext. With this group, even such everyday information as the latest news is not readily obtained, since radio, of course is not usable.

THE GENERAL SYSTEM USED

One of the accessories which is available for the BBC microcomputer is a Teletext adaptor. This adaptor enables the BBC micro to receive pages of Teletext, provided the adaptor is connected to a TV aerial with a good strong signal. A separate Teletext television is not required. As mentioned above, however, the pages of Teletext contain not just textual information but also graphical information. The approach which was followed here for both blind and partially sighted users was to eliminate the graphics from the display and just leave the raw text. The approach then differs, depending on how the material is to be displayed.

GIVING THE PARTIALLY SIGHTED ACCESS TO TELETEXT

Adding a colour monitor and disc drive to the BBC micro and Teletext adaptor provides the system for the partially sighted. The user chooses which channel and page he wishes to see and the BBC micro retrieves the appropriate information. This is then converted into the wholly textual form and is held as a page of text in the computer. The user can then move around the text by pressing the appropriate keys on the computer. One way to think of it is that the computer's screen is a closed-circuit television which looks at a particular part of the Teletext page. An important feature of this is that the display on the computer screen can be adapted to suit a particular user. Features such as text colour, background colour, and the size and spacing of the letters can all be varied.

GIVING THE BLIND ACCESS TO TELETEXT

There are two ways in which Teletext can be presented:

(1) As synthetic speech : essentially this is the same program as the one described above for the partially sighted. The additional feature though is that of a text-to-speech synthesizer. Again, the user can move about the screen with the appropriate keys on the computer, and by pressing other keys can have the information spoken as words or spelt out.

(2) As braille : if a braille device such as the Brailink or Versabraille is added to the system, then the pages of Teletext can be transferred 'live' from the BBC micro to the device. The only extra work here is that the computer has to translate the text of the page into Grade II braille. Fortunately, such a program has been developed for the BBC micro and this is added to the system.

CONCLUDING REMARKS

It should be pointed out that this is very much an on-going development and some problems still exist, as do some other areas to exploit. The major problem at present is to enable a visually impaired user to tune his own Teletext adaptor. The adaptor has to be tuned to each of the four TV channels and can 'drift' off the signal. At present this tuning has to be done by someone who can see the screen. An area which is just developing is that of using the pages from Teletext to produce automatically a braille newspaper. Some limited success has been achieved here, but more work needs to be done.

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